Abhrajyoti Kundu
Computer Science & IT (CS)

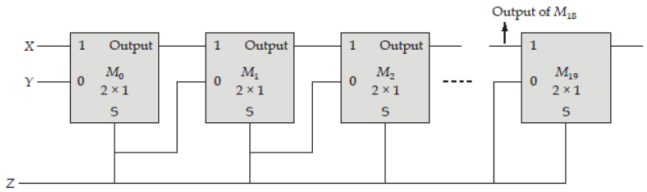
BASIC LEVEL FULL SYLLABUS TEST -1 (GATE 2023) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(65) | CORRECT(44) | INCORRECT(14) | SKIPPED(7)

Q. 41 Have any Doubt ?

Consider the following circuit, consisting of 20, 2 × 1 multiplexers cascaded as shown below:



We have variables *X*, *Y* and *Z*. The output of the multiplexer M_i is fed as the MSB input (I_1) to multiplexer M_{i+1}, and Z is fed as the LSB (or I_0) input and also as select input to all the multiplexers. Then the output of M_{16} (in terms of minimal SOP) is

A $\Sigma m(1, 7)$

B $\Sigma m(2, 3, 5)$

C $\Sigma m(0, 4, 6)$

D $\Sigma m(5, 7)$ Correct Option

Solution :
(d)

o/p obtained at M_0 (or O_{M_0}) $= XZ + YZ'$

o/p obtained at M_1 $= Z(O_{M_0}) + Z'Z^0$
$= Z(XZ + YZ') = XZ$

o/p at M_2, O_{M_2} $= Z(O_{M_1}) + Z'(Z)^0$
$= XZ$

So it can be seen that the o/p stops changing at this point.

Therefore, $O_{M_{16}} = O_{M_1} = XZ$

For SOP expression, $XZ = XYZ + X\bar{Y}Z$
$\equiv \Sigma m(5, 7)$

QUESTION ANALYTICS +

Q. 42 Have any Doubt ?

The value of $\lim_{x\to 0} \frac{x(e^x - 1)}{(1 - \cos x)}$ is _____.

2 Your answer is Correct2

Solution :
2

Apply L' Hospital's rule:

$$\lim_{x\to 0}\left(\frac{(e^x - 1) + xe^x}{\sin x}\right) = \lim_{x\to 0}\left\{\frac{(1+x)e^x - 1}{\sin x}\right\}$$

Apply L' Hospital's rule again,

$\lim_{x\to 0}\left\{\frac{1\cdot e^x + (1+x)e^x}{\cos x}\right\}$ which evaluates to 2

Hence 2 is the answer.

QUESTION ANALYTICS +

Q. 43

Have any Doubt ?

Consider $T(n) = \begin{cases} T(n-1)+\frac{1}{n}; & n>1 \\ 1; & n=1 \end{cases}$, $V(n) = \begin{cases} V\left(\frac{n}{2}\right)+\frac{1}{n}; & n>1 \\ 1; & n=1 \end{cases}$

Then

A $T(n) = O(\log n)$ — Your option is **Correct**

B $V(n) = O(\log n)$ — Your option is **Correct**

C $T(n) = O(V(n))$

D $T(n) \cdot V(n) = O(\log n)$ — Your option is **Correct**

YOUR ANSWER - a,b,d | CORRECT ANSWER - a,b,d | STATUS - ✓

Solution :

(a, b, d)

$$T(n) = T(n-1)+\frac{1}{n}$$
$$= \left(\frac{1}{n}+\frac{1}{n-1}+\frac{1}{n-2}+\ldots\ldots+\frac{1}{3}+\frac{1}{2}+1\right)$$
$$= \left(\sum_{i=1}^{n}\frac{1}{i}\right)$$
$$= O(\log n) \Rightarrow \text{(a) is true}$$

Now, $V(n) = V\left(\frac{n}{2}\right)+\frac{1}{n}$

$$= V\left(\frac{n}{2^2}\right)+\frac{2}{n}+\frac{1}{n}$$
$$= V\left(\frac{n}{2^3}\right)+\frac{2^2}{n}+\frac{2}{n}+\frac{1}{n}$$
$$= V\left(\frac{n}{2^k}\right)+\left(\frac{2^k-1}{n}\right)$$

Putting, $\frac{n}{2^k} = 1 \Rightarrow n = 2^k$ we get

$$V(n) = V(1)+\left(\frac{n-1}{n}\right)$$
$$= 1+\left(1-\frac{1}{n}\right) = \theta(1)$$

Since, $\theta(1) \in O(\log n) \Rightarrow$ (b) is true.

However, since log is asymptotically bigger than constant hence (c) is false.

Checking (d): $T(n) \cdot V(n) = O(1) \cdot O(\log n) = \log n = \theta(\log n)$ (d) is also true.

QUESTION ANALYTICS +

Q. 44

Have any Doubt ?

Consider the following code:

```
void main( )
{
    i/*nt*/a = 10;
    return;
}
```

Number of tokens in the above code is equal to

A 8

B 12

C 13 — Your answer is **Correct**

Solution :

(c)

void	main	(	)	{
1	2	3	4

```
}
```

Therefore number of tokens = 13

D 14

QUESTION ANALYTICS +

Q. 45 Have any Doubt ?

Consider the array A = <4, 1, 3, 2, 16, 9, 10, 14, 8, 7>. After building max heap from the array A, the depth (the longest path from root to the leaf) of the heap and the sum of elements present in the root's right subtree are equal to _____ and _____. (Root is at level 0).

A 3, 22 — Your answer is **Correct**

Solution :
(a)
We can apply build max heap, and the resultant maxheap will have height equal to 3, and the elements present in the right subtree will be 10, 3, 9.
Therefore the sum will be equal to 10 + 3 + 9 = 22.

B 4, 12

C 3, 12

D 5, 22

QUESTION ANALYTICS +

Q. 46 Have any Doubt ?

Consider the following statement:
"Diamonds and Pearls are precious"
Which of the following is/are a correct translation of the above statement?

A $\forall x(\text{Diamond}(x) \vee \text{Pearl}(x) \Rightarrow \text{Precious}(x))$ — Your option is **Correct**

B $\forall x((\text{Diamond}(x) \Rightarrow \text{Precious}(x)) \wedge (\text{Pearl}(x) \Rightarrow \text{Precious}(x))$ — Your option is **Correct**

C $\forall x(\text{Diamond}(x) \wedge \text{Pearl}(x) \Rightarrow \text{Precious}(x))$

D $\forall x(\neg\text{Diamond}(x) \wedge \neg\text{Pearl}(x) \vee \text{Precious}(x))$ — Correct Option

YOUR ANSWER - a,b | CORRECT ANSWER - a,b,d | STATUS - ✗

Solution :
(a, b, d)

Option (a) is true.
Now simplifying (a),

$$\forall x\left(\underbrace{\text{Diamond}(x)}_{p} \vee \underbrace{\text{Pearl}(x)}_{q} \Rightarrow \underbrace{\text{Precious}(x)}_{r}\right)$$

$$\left\{\begin{array}{l} p \vee q \Rightarrow r \\ \equiv (\neg p \wedge \neg q) \vee r \\ \equiv (\neg p \wedge \neg q) \vee (r \vee r) \\ \equiv (\neg p \vee r) \wedge (\neg q \vee r) \\ \equiv (p \Rightarrow r) \wedge (q \Rightarrow r) \end{array}\right\}$$

Therefore we have $\forall x((\text{Diamond}(x) \Rightarrow \text{Precious}(x)) \wedge (\text{Pearl}(x) \Rightarrow \text{Precious}(x))$
So option (b) is true.
(c) is obviously false, as it is not possible for any element in the domain to be Diamond and Pearl at the same time.
(d) is simply an expansion of the implication in option (a). $[p \Rightarrow q \Leftrightarrow \neg p \vee q]$

QUESTION ANALYTICS +

Q. 47 Have any Doubt ?

The expected number of times a fair coin needs to be tossed, so that 3 consecutive heads are obtained, is equal to _____.

14 — Your answer is Correct14

Solution :
14

Let k be the expected number of tosses required.

Then the following condition must hold:

$$k = \frac{1}{8}\times 3+\frac{1}{2}\times(k+1)+\frac{1}{4}\times(k+2)+\frac{1}{8}\times(k+3)$$

Solve to get, $k = 14$

QUESTION ANALYTICS +

Q. 48 Have any Doubt ?

Consider 3 processes whose arrival and burst times are given below:

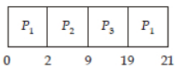
Process	Arrival time	Burst time	Priority
P_1	0	4	3 (lowest)
P_2	2	7	1 (highest)
P_3	3	10	2

If the system uses the preemptive priority scheduler, then the average waiting time of a process is equal to _____.

7.66 — Correct Option

Solution :
7.66

Gantt chart:



Waiting time of P_1 = (19 – 2) = 17 units

Waiting time of P_2 = 0 units

Waiting time of P_3 = (9 – 3) = 6 units

$$\therefore \text{ Average waiting time } = \frac{(17+0+6)}{3}=\frac{23}{3}=7.66 \text{ units}$$

Your Answer is 7.67

QUESTION ANALYTICS +

Q. 49 Have any Doubt ?

A network with CSMA/CD protocol in the MAC layer is running at 1 Gbps over a 1 km cable with no repeaters. The signal speed in the cable is 2×10^8 m/sec. The minimum frame size for this network should be

A 1000 bits

B 1250 bytes — Your answer is Correct

Solution :
(b)

Consider for minimum frame size:

$$T_t \geq 2 \times T_p$$

or, $$L \geq (2 \times T_p) \times (\text{Bandwidth})$$

Substitute values, $$L \geq 2\times\frac{10^3 \text{ m}}{2\times10^8 \text{ m/sec}}\times 10^9 \text{ bits/sec}$$

$$L \geq \left(\frac{1}{10^5}\times 10^9\right)\text{bits} = 10^4 \text{ bits}$$

$$L_{min} = 10^4 \text{ bits} = 1250 \text{ bytes}$$

C 5000 bits

D 5000 bytes

QUESTION ANALYTICS +

Q. 50 Have any Doubt ?

Consider the following functions, black( ) and white( ):

```
void black(char*s)
{
    if(!s[0]) return;
    black(s + 1);
    black(s + 1);
    printf("%c", s[0]);
}
void white(char*s)
{
    if(!s[0]) return;
    white(s + 1);
    printf("%c", s[0]);
    white(s + 1);
}
```

The outputs obtained corresponding to the function calls, black("213") and white("213") will be

A 3313312, 3132313 — Your answer is **Correct**

Solution :
(a)
The question can be easily be done without even lifting the pen, using the necessary condition that whatever the output of black( ) and white( ) may be, both the functions must output the same number of characters. So options (b), (c) and (d) are ruled out as both don't print equal number of characters, and therefore option (a) is the correct choice.

B 3313312, 313231

C 331331, 3132313

D 3313312, 332313

QUESTION ANALYTICS +